This document contains excerpts from the X-34 Independent Assessment Report (title page shown below). Only those sections which relate to the PBMA element **Concept Development** are displayed.

The complete report is available through the PBMA web site, Program Profile tab.

X-34

Safety & Mission Assurance Review

NASA
Office of Safety & Mission Assurance

June 17, 1998

2.3 X-34 Vehicle Characteristics

The vehicle is being designed and developed by Orbital Sciences Corporation however, it will be powered by a government-furnished engine. The main engine is a 60,000 pound thrust version of the FASTRAC LOX/kerosene engine being developed by the Marshall Space Flight Center. This is a simple engine which uses a gas generator cycle and a single turbopump based on the previously developed Marshall Simplex LOX pump.

The X-34 is considerably smaller and lighter than the X-33. It is capable of hypersonic flight to Mach 8, compared with the X-33's Mach 15. Consequently, it is considerably less expensive and simpler to develop, to operate, and to modify for flight experiments. It has different embedded technologies and a different operational concept. Flight testing will focus on RLV-type operations, the embedded technologies, and technology test articles to be carried as experiments.

Test-bed instrumentation will satisfy the needs for the embedded technologies demonstration, and for some additional experiments to be carried. Additional instrumentation requirements will be dictated by the demands of the experiments to be conducted. Figures 2.1 and 2.2 provide schematic and expanded views of the X-34 vehicle.

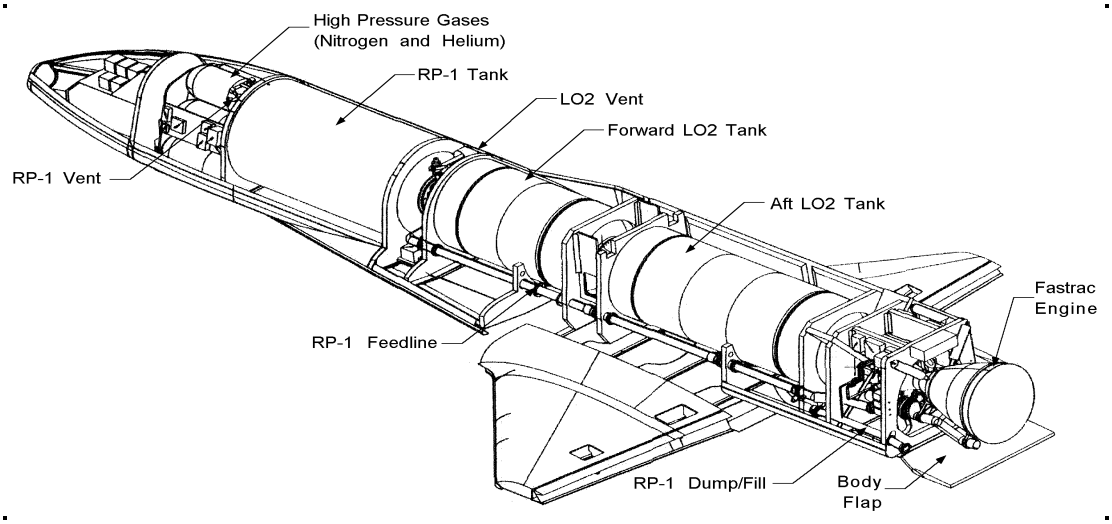

Figure 2.1: X-34 Schematic Drawing

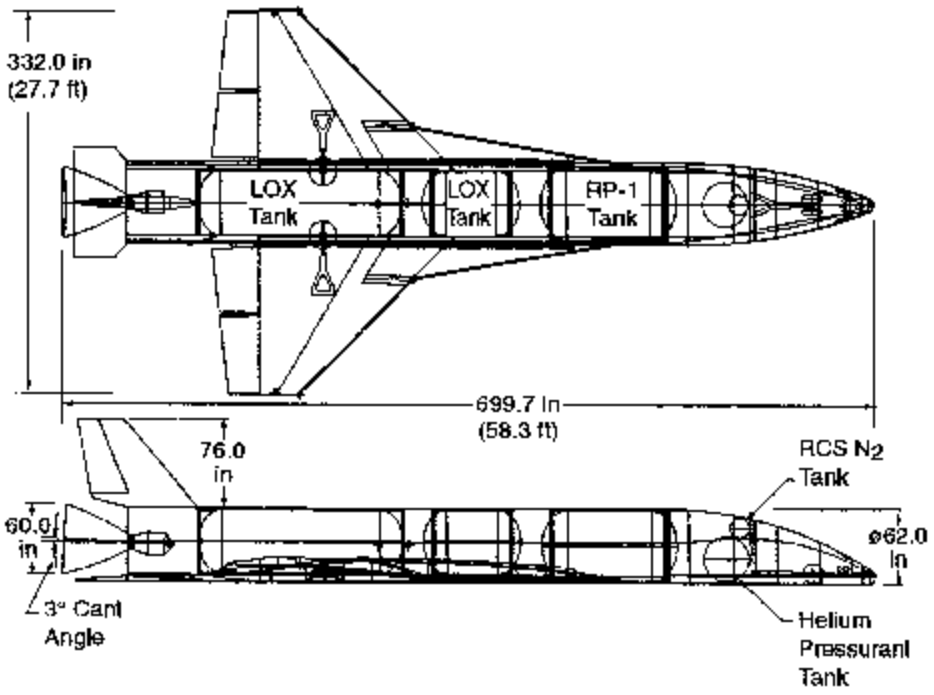

Figure 2.2: X-34 Expanded View

2.4 X-34 Propulsion

The FASTRAC engine is one element of NASA's Advanced Space Transportation Program, managed at MSFC. The program is designed to reduce the cost of space launch and develop technologies for space transportation needs for the next 25 years. Each FASTRAC engine (see Figure 2.3) initially will cost approximately $1 million -- about one-fourth of the cost of similar engines. The FASTRAC provides 60,000 pounds of thrust and, in addition to the X-34 vehicle, is targeted for launch systems designed to boost payloads weighing up to 500 pounds at a dramatically lower cost.

The modular X-34 design permits engine removal and replacement. It may be adaptable for subsequent testing of more advanced propulsion technologies such as rocket based combined cycle, plug nozzle, pulse detonation wave rocket, and dual expansion engines.

The FASTRAC thrust chamber assembly and nozzle are currently undergoing testing at MSFC. Other components, such as the LOX turbopump and gas generator have completed preliminary testing. The complete engine assembly will be tested at Stennis Space Center, in Mississippi, during the fall of 1998. The first engine hotfire is scheduled for September 1998.

FASTRAC 60K Engine

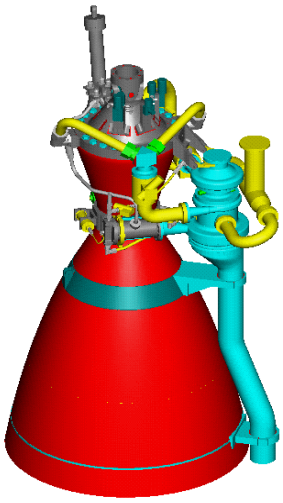

Figure 2.3 FASTRAC Engine

2.5 X-34 Operational Concept

The overall operational concept or approach to flight testing of the X-34 test bed demonstration vehicle is depicted in Figure 2.4

Specifically, the flight test program consists of two phases. In Phase I, the Baseline Flight Test Program, two flight vehicle airframes will be designed and built, and two envelope expansion flights will be conducted at White Sands Missile Range (WSMR) (see Figure 2.5). The first flight, an unpowered flight into White Sands Space Harbor (WSSH) using an engine simulator, is scheduled to be completed by March 1999. The second flight, the first powered flight using the MSFC FASTRAC engine, is designed to reach approximately Mach 2.6 and 85,000 ft altitude. This flight is scheduled to be completed by August 1999.

Phase II, the Optional Flight Test Program (OFTP), would provide for up to 25 additional flights to be completed within a one-year time period. The objective of the OFTP would be to demonstrate:

- autonomous flight operations, including return and landing to a designated landing site
- vehicle safe abort
- operations in expected RLV-type environments, such as landing in cross winds up to 20 knots and subsonic flight through rain and fog
- powered flight to at least 250 kft and Mach 8 or greater
- embedded RLV technologies and the ability to readily accommodate other RLV technologies

The OFTP remains an option in terms of the current contract. Thus, supporting analyses and decisions concerning possible test sites remain to be completed. However, one alternative that has received preliminary consideration involves operations out of the Eastern Range at KSC Cape Canaveral Air Force Station (CCAFS) as shown in Figure 2.6

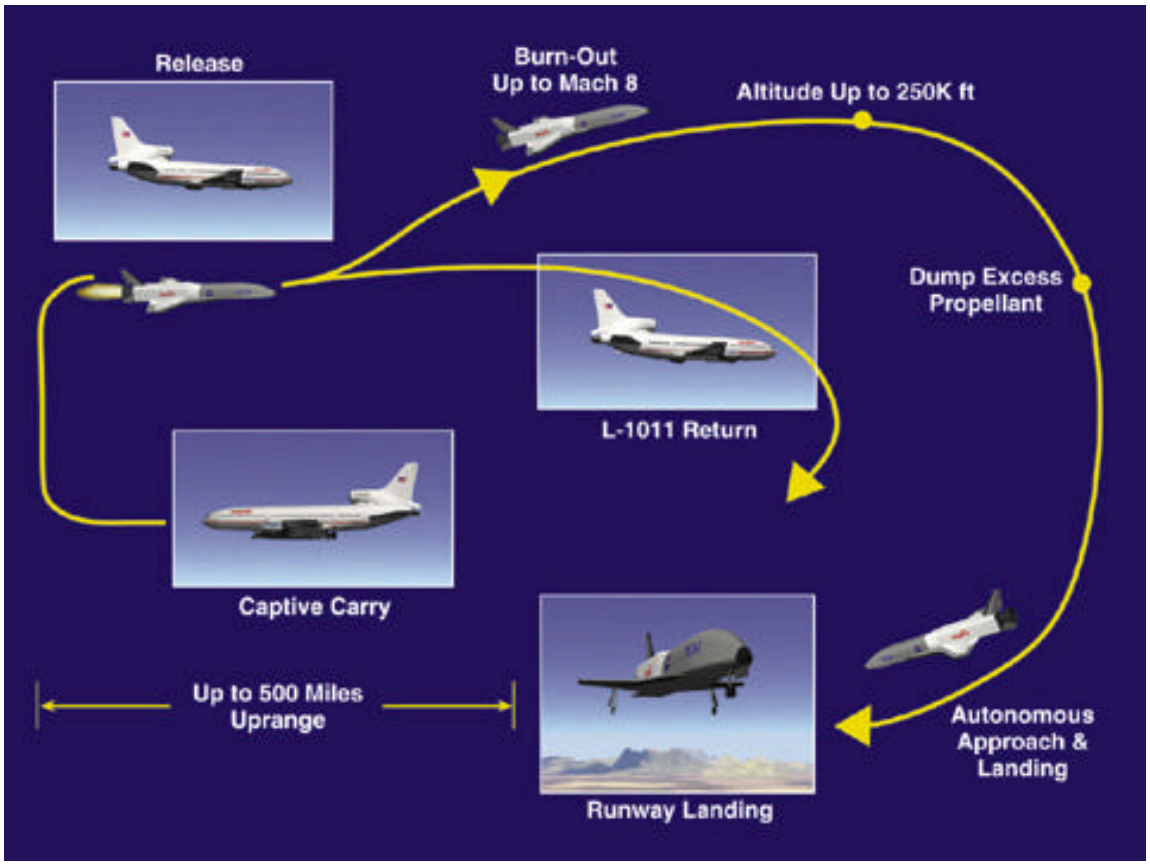

Figure 2.4 Operational Concept

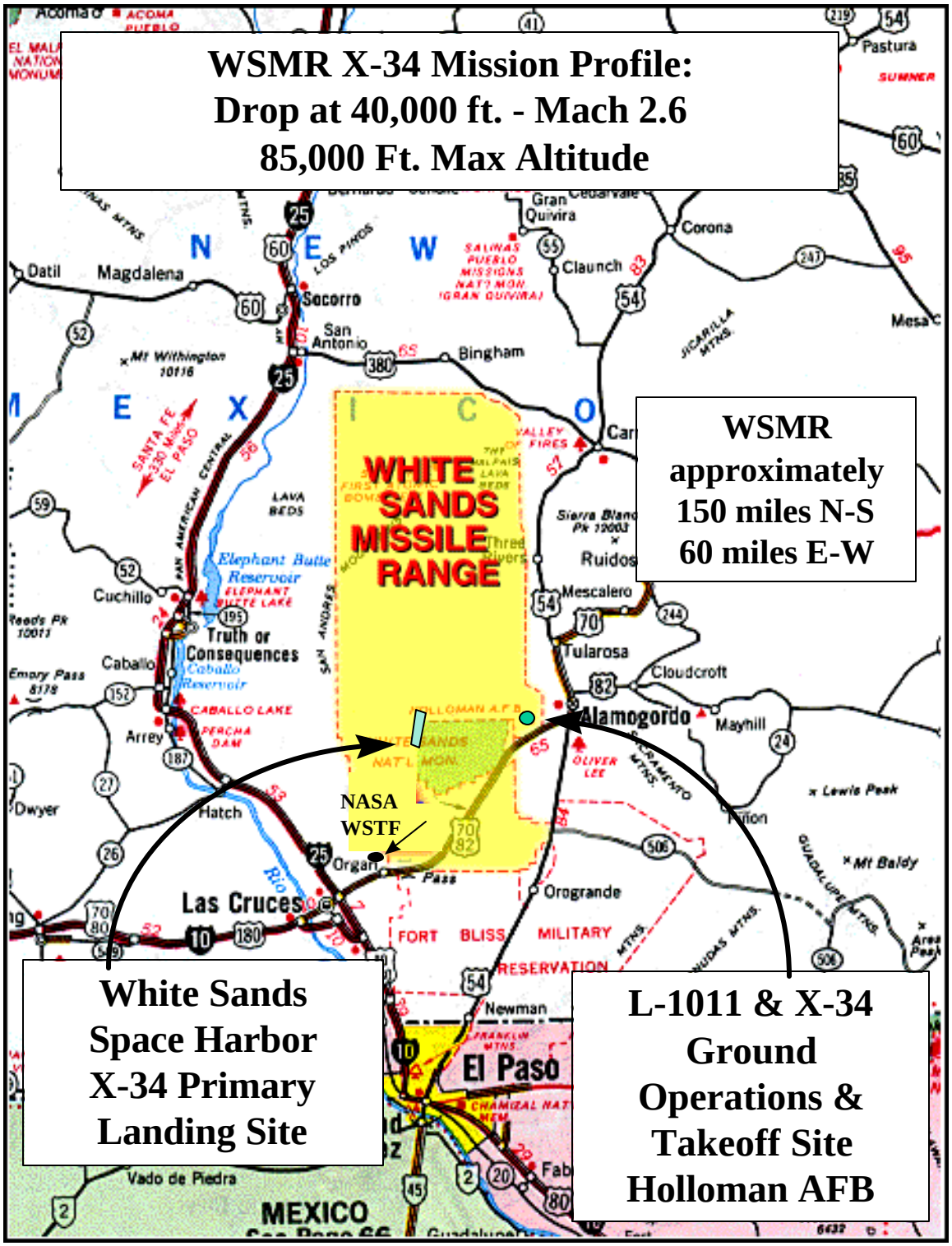

Figure 2.5 White Sands Missile Range Operations
(Baseline Flight Test Program)

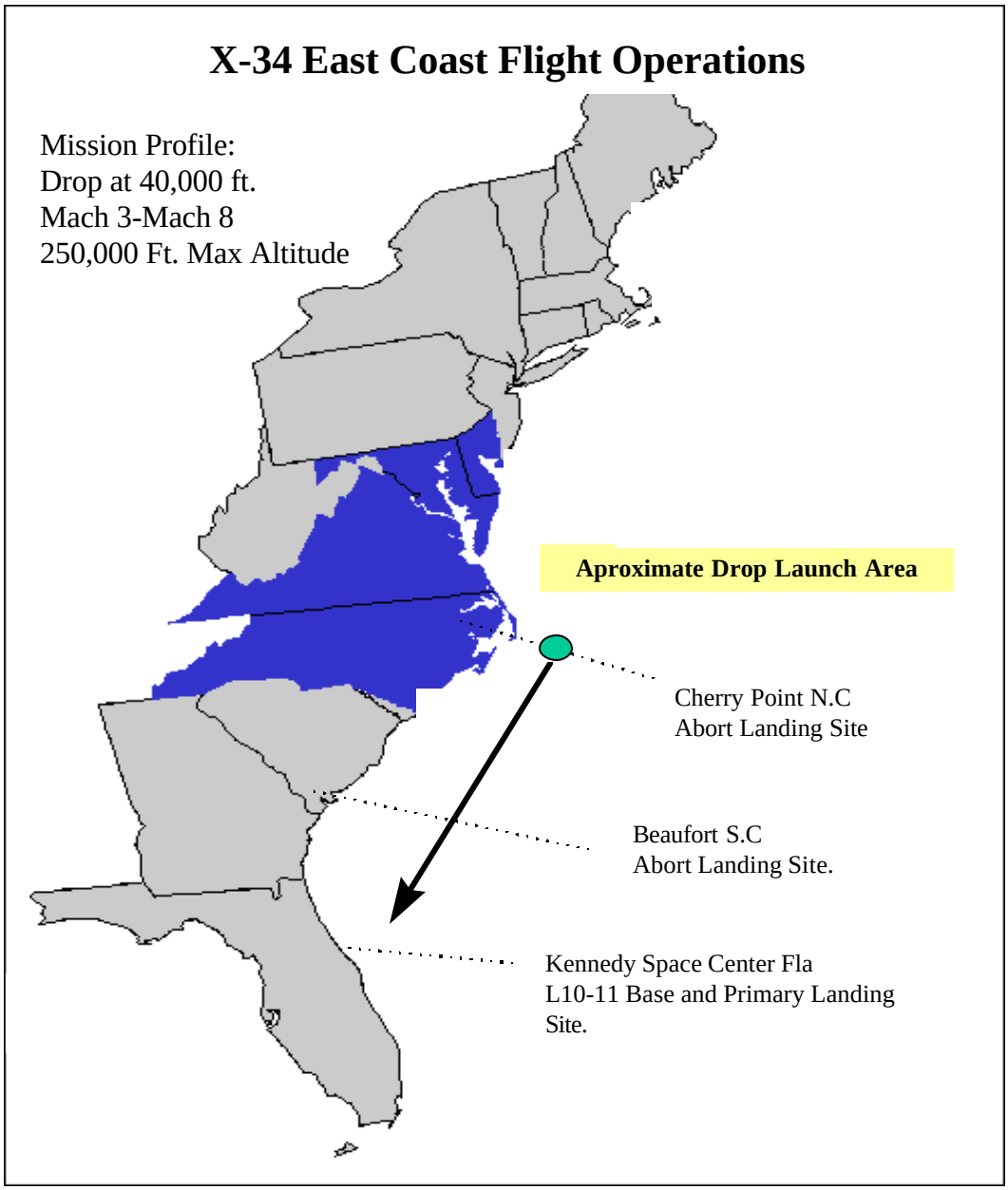

Figure 2.6 Eastern Test Range Operations